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10/586,369	07/18/2006	Klaus Bohmhammel	292187US0PCT	2990

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EXAMINER

NGUYEN, NGOC YEN M

ART UNIT	PAPER NUMBER
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1793

NOTIFICATION DATE	DELIVERY MODE
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06/10/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/586,369	Applicant(s) BOHMHAMMEL ET AL.	
	Examiner Ngoc-Yen M. Nguyen	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 March 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 24-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There is no sufficient support in the instant specification for the limitation "at least 15.3%" in claim 24 or "at least 21.1%" in claim 25. It is noted that "15.3%" and "21.1%" can be found in Table 1 and Table 3, respectively, however, the "at least" language, as required in claims 24-25, includes values higher than those disclosed in Tables 1-3, including 100%, and such high values do not have support in the instant specification.

Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In the independent claim 1, the claim is drawn to a process for converting SiCl_4 to HSiCl_3 , however, in claim 18, the

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step of *using* the HSiCl_3 to produce another different product, such as alkoxysilanes, organochlorosilanes, monosilane, silicon, etc., does not further limit the subject matter of claim 1, which is a process of *producing* HSiCl_3 because HSiCl_3 is no longer the final product in claim 18.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 57-118017 in view of Yamanaka et al (6,653,212), further in view of Rodgers (3,933,985).

JP '017 discloses a process for producing SiHCl_3 in high yield. In the process, SiCl_4 is mixed with H_2 in 4:1 to 1:10 molar ratio and introduced into the first reactor B, and by electrifying a graphite resistance 1, the interior of the reactor B is heated to 500-1,300°C to produce SiHCl_3 as well as HCl by-product in the presence of catalyst 9 (note English abstract). In JP '017, any unreacted reactants can be transferred to the second reactor to further produce SiHCl_3 and this step can be deleted along with its function, In re Wilson 153 USPQ 740 (CCPA 1967).

The SiCl_4 to H_2 ratio as disclosed in JP '017 overlaps the claimed range. With respect to the encompassing and overlapping ranges previously discussed, the subject

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matter as a whole would have been obvious to one of ordinary skill in the art at the time of invention to select the portion of the prior art's range which is within the range of the applicants' claims because it has been held prima facie case of obviousness to select a value in a known range by optimization for the results. *In re Boesch*, 205 USPQ 215.

Additionally, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time invention was made to have selected the overlapping portion of the range disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness. *In re Malagari*, 182 USPQ 549.

For the pressure, space velocity for the reaction, it would have been obvious to one of ordinary skill in the art to optimize these conditions through routine experimentation in order to obtain the best results.

For the construction material for the reactor of JP '017, it would have been within the skill of the artisan to select a construction material for the reactor that can withstand the reaction conditions.

The differences are JP '017 does not disclose (1) the use of a metal heating element (the heating element in JP '017 is a graphite resistance) and (2) the fractionating or at least condensing the product mixture (step (a)) or passing the product stream to a direct further use (step (b)).

For difference (1), Yamanaka '212 discloses a thin film forming apparatus comprising a vacuum chamber, a substrate, a thermal catalyst, and a heating means for heating the thermal catalyst, wherein a gas introduction system for introducing a gas is connected to the vacuum chamber and wherein the gas is fed from the gas introduction

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system into the vacuum chamber to form a thin film on a surface of the substrate by utilizing a thermal decomposition reaction and a catalytic reaction by the thermal catalyst, the gas introduction system introduces a carrier gas containing hydrogen and a material gas for forming the thin film on the substrate, and the apparatus comprises a means for raising a concentration of the material gas in the vacuum chamber in the middle of the formation of the thin film on the substrate (note claim 1).

The thermal catalyst contains at least one type of material selected from a group consisting of tungsten, tungsten containing thoria, platinum, molybdenum, palladium, tantalum, metal deposited ceramics, silicon, alumina, silicon carbide, refractory metals (tungsten, tantalum, tungsten containing thoria, molybdenum, titanium, etc.) coated with silicon carbide or ceramics or conductive nitride films, silicon nitride or oxide, conductive metal nitrides (tungsten nitride, titanium nitride, molybdenum nitride, tantalum nitride, etc.), boronitride (BN), and silicide (note claim 24). The "at least one" fairly suggests a combination of two or more of the above listed compounds can be used, such as an alloy of more than 2 metals, etc. The thermal catalyst is preferred to be a wire made of tungsten, palladium, tantalum or molybdenum (note column 32, lines 63-65). The thermal catalyst 5 is not limited to one formed into a coil as shown in Figures 1-3. It is also possible to form it into a grid as shown in FIG. 6. The grid-like thermal catalyst is formed by for example assembling a plurality of wires having predetermined lengths in a grid and joining assembly portions of the wires by welding or the like. Further, it is also possible to form the thermal catalyst by winding a wire, coil, or the like of the thermal catalyst one or more times around a high heat resistant insulator such as ceramics, and

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quartz glass. Alternatively, it is also possible to press it to a flat metal plate to form the grid (note paragraph bridging column 43-44). The power supply in the present example is a DC power supply or an AC power supply or a power supply wherein the AC is superposed on the DC and is selected in accordance with the situation. By adjusting the voltage and/or current of the power supply, it becomes possible to adjust the temperature of the thermal catalysts (note column 45, lines 1-10).

Yamanaka '212 also discloses that the apparatus can be used to produce a film of Si and Poly-Si, produced from SiH_4 , SiHCl_3 , SiCl_4 , etc. (note column 48, lines 52-54).

Thus, Yamanaka '212 fairly teaches that the thermal catalyst can be safely used in an atmosphere containing SiCl_4 , SiHCl_3 and H_2 .

For the combined teaching of JP '017 and Yamanaka '212, when the thermal catalyst, which is made from the preferred metals, tungsten, palladium, tantalum or molybdenum, is used in the process of producing SiHCl_3 , the thermal catalyst would inherently have the effect on the process as when the claimed heating element is used.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thermal catalyst, as suggest by Yamanaka '212, for heating the reactor in the process of JP '017 because such thermal catalyst is used for same purpose in an analogous condition.

Rodgers '985 can be applied to teach that when SiCl_4 is used to produce Si (as desired in the process of Yamanaka '212), the reaction between SiCl_4 and hydrogen is too slow, so the SiCl_4 normally reacts with hydrogen to form SiHCl_3 first then the SiHCl_3 is subsequently converted to Si.

Thus, Rodgers '985 fairly suggests that when SiCl_4 is used as the starting reactant in Yamanaka '212, the thermal catalyst in Yamanaka '212 may serve as a catalyst to promote the formation of SiHCl_3 from SiCl_4 first, before the SiHCl_3 is converted to Si film.

For difference (2), JP '017 discloses that in the second reactor, the mixed gas containing the residual unreacted SiCl_4 and H_2 is cooled and passed through a fixed metallic Si bed, the HCl is converted into SiHCl_3 by a reaction with the metallic Si. The resulting mixed gas of H_2 , SiCl_4 and SiHCl_3 is taken out of the exhaust port, and the SiHCl_3 is separated and collected (note English abstract).

JP '017 does not specifically disclose how the SiHCl_3 is separated.

Rodgers '985 discloses that after a mixture of hydrogen and silicon tetrachloride is passed through a furnace reactor unit at suitable rates and temperatures to convert a portion of the silicon tetrachloride to trichlorosilane, the reaction products from the furnace are passed through a pre-cooler to lower the temperature of the products to approximately room temperature and the room temperature gases are then passed through a condenser unit to separate the hydrogen and hydrochloric acid reaction products from the silicon tetrachloride and chlorosilane liquid products. The hydrogen gas and the hydrochloric acid gaseous products are directed through a water scrubber which separates the hydrochloric acid from the hydrogen and the hydrogen gas after suitable drying can be reused as the hydrogen source. The liquid mixture of silicon tetrachloride and trichlorosilane is passed through a distilling unit which separates the

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trichlorosilane product from the silicon tetrachloride which later can be recycled (note paragraph bridging columns 2-3).

For the combined teaching of JP '017 and Rodgers '985, when the second step as disclosed in JP '017 is omitted, it would have been obvious to one skilled in the art to separate the mixed gas obtained from the first reactor (reactor "B" in Figure 3) into the product stream SiHCl_3 , the unreacted SiCl_4 stream, and the H_2 and by-product HCl stream as suggested by Rodgers '095 (note Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to separate the hydrogen from the silicon tetrachloride and the trichlorosilane in the process of JP '017 by condensing method and to separate the silicon tetrachloride from the trichlorosilane by distilling method (which is considered the same as the claimed "fractionating") as suggested by Rodgers '985 in order to recover hydrogen and silicon tetrachloride for recycling purposes.

Rodgers '985 is also applied to teach that after the SiHCl_3 is formed, the SiHCl_3 is fed to a subsequent step to produce Si (note column 1, lines 34-40 and Figures 1-2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the SiHCl_3 produced in the process of JP '017 as the reactant to produce Si as suggested by Rodgers '985 because using a product from one reaction as reactant for another reaction is well within the skill of the artisan.

Applicant's arguments filed March 12, 2009 have been fully considered but they are not persuasive.

For the new claim 27, reaction between SiCl_4 and hydrogen inherently produces HCl as evidenced by JP '017 (note abstract) and Rodgers '985 (note equation 1 in Column 3).

Applicants argue that one of ordinary skill in the art would not be motivated to use a metallic heating element to make an HCl-containing product because HCl would corrode the metallic heating element.

In Yamanaka '212, the metallic heating element is used in a process of producing a Si thin film using SiHCl_3 and SiCl_4 as reactants (note column 48, lines 53-54). Also in Yamanaka '212, hydrogen is usually used as cleaning agent (note column 36, lines 32-42). Thus, in the process of Yamanaka '212, in the presence of hydrogen and SiHCl_3 or SiCl_4 , HCl may have been formed according to the reactions (1) and (2) disclosed in Rodgers '985 (note column 3), this fairly suggests that the metallic heating element in Yamanaka '212 could withstand the acidic environment (the presence of HCl) of the process. Furthermore, Applicants' claims do not require that the claimed heating be free of corrosion.

Applicants argue that as shown in the MSDS for HCl, most metals react with HCl in a corrosive manner liberating flammable hydrogen gas.

As clearly stated in the MSDS, "most" metals, but not all metals, react with HCl. Metals or metal alloys having acid resistance (e.g., HCl resistance) are known in the art, such as platinum group metals (note Shimamune et al, 6,126,796, column 5, lines 26-30), Ni-W alloy (note Ito et al 5,927,865, column 1, lines 50-56). For the combined teaching of JP '017 and Yamanaka '212, it would have been obvious to one skilled in

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the art to select a thermal catalyst listed in Yamanaka '212 that is acid resistant as the heating element in the process of JP '017.

Applicants argue that the process of JP '017 converts harmful HCl into SiHCl_3 .

The step of converting HCl into SiHCl_3 as disclosed in JP '017 is to increase the yield of the process, thus it would have been obvious to one skilled in the art to eliminate such step along with its function, In re Wilson 153 USPQ 740 (CCPA 1967).

Applicants argue that JP '017 discloses that the reaction of the JP '017 is carried out such that HCl is removed from the product before it exits the reactor.

It should be noted the process as disclosed in JP '017 has two steps, a first step of reacting SiCl_4 with hydrogen in a first reactor (note reactor "B" in Figure 3) and a second step of reacting the mixed gas containing the residual unreacted SiCl_4 and hydrogen in the second reactor to convert HCl in the mixed gas into SiHCl_3 in the second reactor (note reactor "I" in Figure 3). Thus, the mixed gas leaving the first reactor does contain SiHCl_3 and HCl as required in Applicants' claims. Again, the reaction carried out in the second reactor can be eliminated along with its function.

Applicants argue that claim 28 recites a process in which a product mixture that contains HSiCl_3 and HCl is subjected to fractionation or at least partial condensation.

The mixed gas obtained from the first reactor in the process of JP '017 contains unreacted SiCl_4 , H_2 and by-product HCl in addition to the SiHCl_3 product (note abstract), and Rodgers '985 is applied as stated above to teach the step of separating the SiHCl_3 from other unreacted and by-products, i.e. SiCl_4 , H_2 , and HCl (note Figure 1).

Applicants argue that JP '107 and Yamanaka are non-analogous arts.

Applicants argue that claim 29 does not form SiHCl_3 by the reaction of HCl with metallic Si.

Again, the second step of reacting HCl contained in the mixed gas from the first reactor with Si, as disclosed in JP '017 can be deleted along with its function.

In response to applicant's argument that Yamanaka is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, an electric source is supplied to the graphite resistance to directly heat the reactor in the process of JP '107 and the atmosphere in the reactor comprises hydrogen, silicon tetrachloride (as reactants) and trichlorosilane (as the product). In Yamanaka '212, an electric source is also supplied to the thermal catalyst to heat up the reaction chamber and the reaction chamber contains hydrogen, silicon tetrachloride and/or trichlorosilane. Thus, the graphite resistance of JP '107 and the thermal catalyst of Yamanaka '212 are considered as analogous heating means for being used in an atmosphere containing hydrogen, silicon tetrachloride and trichlorosilane.

Applicants argue that Rodgers teaches away from the combination of Yamanaka and JP '017 because Yamanaka '212 deposits a Si film while Rodgers '985 discloses that the deposition of silicon within a reaction furnace should be prevented.

As clearly disclosed in Rodgers '985, the reaction between SiCl_4 and hydrogen is reversible, and the direction of the reaction depends on pressure, silicon/chlorine/

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hydrogen ratio, and temperature (note column 1, lines 53-62 and Figure 3). Thus, regardless of what being used as the heating element in the process JP '017, it would have been obvious to one skilled in the art to control the amount of SiCl_4 used, the temperature, etc., to carry out the process of producing trichlorosilane of JP '017 without depositing Si by controlling the percent of silicon tetrachloride in the gaseous mixture and the temperature (note column 3, lines 9-19).

The 112, 2nd paragraph rejection is withdrawn with the understanding that the "consists" language of claim 1 would only exclude non-metal materials, but not excluding metal alloy.

Applicants argue that claim 1 is a "comprising" claim which does not exclude any further steps subsequent to or prior to the formation of HSiCl_3 .

Granted that it is true, however, any extra steps that may be included in the "comprising" language must pertain to the process of "catalytic hydrodehalogenation of SiCl_4 to form HSiCl_3 ", in this case, the process as claimed in claim 18 relates to a process of producing alkoxysilanes, organochlorosilanes, etc., not HSiCl_3 .

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner can normally be reached on Part time schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/
Primary Examiner, Art Unit 1793

nmn
June 8, 2009